Translation of German Utility Model G 92 08 103.7

Puncture device

The invention relates to a puncture device, in particular for placement of a catheter using a closed Seldinger technique.

To introduce a venous catheter into the body of a patient, the vein is punctured with a cannula. In the Seldinger technique, a mandrin is introduced through the puncture needle or through a plastic cannula into the vein, and the catheter is pushed over the mandrin. When the vein has been punctured with the puncture cannula, blood flows into the puncture cannula. A syringe, half filled with saline solution, is often attached to the puncture cannula. The success of the puncturing procedure can be established by the fact that blood is able to be drawn into the syringe.

In a procedure involving deliberate puncture of a vein, there is a danger of hitting an artery instead of the vein. The pressure in the artery is greater than the pressure in the vein. Moreover, the color of venous blood differs from that of arterial blood. However, it is often not possible to detect an arterial puncture from the color of the blood, in particular if the blood is mixed with another liquid, for example saline solution. It is true that an arterial puncture can easily be detected from the more rapidly escaping blood, if the puncture is performed in an open system in which blood is at times able to flow out from the rear end of the puncture cannula, but such detection is difficult in a closed system in which a membrane or

a valve is provided to prevent escape of the blood.

The object of the invention is to make available a venous puncture device with which it is easily possible to detect inadvertent puncturing of an artery.

According to the invention, this object is achieved by the features set out in claim 1.

In the venous puncture device according to the invention, a display device is provided which is or can be connected to the puncture cannula. This display device has an at least partially transparent display chamber which is connected to the blood inlet via a pressure valve. The pressure valve is configured in such a way that it does not open at venous blood pressure, but does open at arterial blood pressure. Arterial blood pressure is generally above 50 mmHg at all times, while venous blood pressure is lower. The pressure valve therefore has a response threshold of about 50 mmHg. The pressure prevailing in the display chamber is the surrounding atmospheric pressure, this being achieved by providing the display chamber with an air passage which leads to the atmosphere and which is impermeable to liquid. Another air passage impermeable to liquid bypasses the pressure valve located between the blood inlet and the display chamber, so that air arriving at the air inlet of the display device is able to escape through the two air passages to the environment when blood flows in the direction toward the display chamber. As soon as it can be seen, through the wall of the display chamber, that blood is entering the display chamber, the response pressure of the pressure valve has been exceeded.

This indicates that an artery has been hit.

A prechamber into which blood flows after puncture of a blood vessel is expediently present between blood inlet and display chamber. The wall of the prechamber is at least partially transparent. If blood passes only into the prechamber, and not into the display chamber, this indicates that a vein has been hit. If an artery is hit, then the prechamber fills and, thereafter, also the display chamber.

The invention permits safe monitoring of the success of puncturing of a vein and affords a distinction between a venous puncture and an arterial puncture. To detect a venous puncture, it is not necessary to employ criteria that are difficult to differentiate, for example the speed of escape of the blood or the color of the blood. The device according to the invention can be used both for puncturing veins and for puncturing arteries. It permits differentiation between veins and arteries and, therefore, reliable locating of the type of vessel sought in each case.

The puncture device according to the invention is particularly suitable for use in catheter sets for placement of a catheter using a closed Seldinger technique in which, before insertion of the catheter, a temporary escape of blood is prevented by sealing devices and membranes.

An illustrative embodiment of the invention is explained in greater detail below on the basis of a venous puncture device and with reference to the drawings, in which:

Fig. 1 shows a side view of a venous puncture device, in

partial cross section, and

Fig. 2 shows a longitudinal section of the display chamber.

The venous puncture device according to Fig. 1 has a steel cannula 10 which, at the front end, is provided with a bevel 11 for insertion into the body of the patient. At the rear end of the steel cannula 10, there is a cannula attachment piece 12 with a main part 13 continuing in a straight line from the steel cannula 10, and with a branch 14 branching off at an angle. A syringe 16, whose syringe plunger is designated by 17, is connected to the main part 13 by way of a Luer lock connector 15.

The branch 14 contains a connection device 18 in which a slotted or holed seal 19 is arranged which seals the branch off from the environment but can be pierced from the outside.

The display device 20 is joined to the connection device 18, said display device 20 having a projecting connector 21 which can be pushed through the opening of the seal 19 and thereby creates a connection between the inside of the branch 14 and the inside of the display device 20.

The display device 20, which is shown in Fig. 2, has a cylindrical housing 22, the connector 21 projecting from one end of the latter, while its other end contains an air passage 23 which is impermeable to liquid and is in the form of a hydrophobic membrane. The connector 21 forms the blood inlet 24 of the housing. This blood inlet 24 leads into a prechamber 25, which is adjoined by a display chamber 26. Between the prechamber 25 and the display chamber 26 there is a wall 27 in

which air passages 28 are provided in the form of apertures which are covered with hydrophobic filters 29 so that the air passages 28 are impermeable to liquid.

A pressure relief valve 30 is also provided in the wall 27 and is here shown as comprising an elastomeric body 31 secured on the wall and having a lip-shaped edge 32 which closes off openings 33 in the wall 27. The lip-shaped edge 32 is situated in the display chamber 26. When the pressure in the prechamber 25 exceeds a limit value, the edge 32 is forced away from the wall 27 by this pressure, so that the openings 33 are freed. The pressure relief valve 30 at the same time forms a nonreturn valve which prevents reverse flow from the display chamber 26 into the prechamber 25. The pressure relief valve 30 opens when the pressure difference between prechamber 25 and display chamber 26 is greater than 40 mmHg, for example. In a procedure for puncturing a vessel, the syringe 16 is connected to the main part 13 of the puncture cannula 10. The syringe 16 is half filled with a saline solution. During the puncturing procedure, a slight pressure is applied to the syringe plunger so that the liquid column present in the steel cannula 10 acts like a mandrin and prevents tissue being punched out by the bevel 11. Once a blood vessel has been punctured, the syringe plunger yields. The syringe plunger can then be pulled back to draw liquid into the syringe 16.

During puncturing of the blood vessel, the display device 20 is not present on the branch 14, and the seal 19 is closed. Only when the puncturing procedure has been completed is the

display device 20 fitted in place, with the connector 21 penetrating the seal 19. The pressure of the blood vessel now prevails in the prechamber 25 of the display device, while the display chamber 26 is initially free of pressure. If a vein has been punctured, only the prechamber 25 fills with blood. Air escapes through the air passages 28 from the prechamber 25 into the display chamber 26 and from the latter into the atmosphere via the passage 23. If the prechamber 25 is filled with blood and if the blood pressure is so great that the pressure relief valve 30 opens, blood then passes through the openings 33 into the display chamber 26. The user detects from this that an artery has been hit.

After a vein has been punctured, and after this has been verified with the aid of the display device 20, said display device can be removed from the branch 14. A guide wire is then introduced through the seal 19 and, after removal of the puncture cannula 10, the catheter can then be introduced over said guide wire. It is also possible to introduce the guide wire through the syringe 16.

Claims

1. A puncture device with a puncture cannula (10), wherein a display device (20) is provided which is or can be connected to the puncture cannula and which, between a blood inlet (24) and a transparent display chamber (26), contains a pressure valve (30) which opens at arterial blood pressure and does not open at venous blood pressure, and at least one air passage (28; 23) impermeable to liquid is provided in each case between the blood inlet (24) and the display chamber (26) and also between the display chamber (26) and the environment.

2. The puncture device as claimed in claim 1, wherein a transparent prechamber (25) is arranged between the blood inlet (24) and the display chamber (26), and the pressure valve (30) and the one air passage (28) are arranged between the prechamber (25) and the display chamber (26).

3. The puncture device as claimed in claim 1 or 2, wherein the display device (20) has a connector (21) which can be pushed into a self-closing seal (19) in the attachment piece (12) of the puncture cannula (10) in order to open said seal (19).

4. The puncture device as claimed in claim 3, wherein the seal (19) is arranged in a branch (14) of the attachment piece (12) of the puncture cannula (10), and a syringe (16) is provided which can be connected to the main part (13) of the attachment piece (12).